Broadband Wireless Access
Band Plan and Spectrum Etiquette Meeting
August 10, 1998

On Monday August 10th, following the all-day August 9th N-WEST kickoff meeting at the Sheraton Colorado Springs, we held a three-hour meeting of individuals and companies interested in the topic of BAND PLAN AND SPECTRUM ETIQUETTE. This is a summary of discussions and suggestions made by the 23 people in attendance. A list of attendees is available from N-WEST.

The framework for this meeting was the common goal of establishing a voluntary standard for Broadband Wireless Access equipment and spectrum etiquette in frequency bands from 10 GHz and higher, with emphasis on the delivery of commercial services.

1 Band Use Plan

All attendees agreed that the different band segments of the U.S. A-Block and B-Block allocations should be flexibly used at the operator's discretion, and that standards should not be recommended for service types or equipment operating modes by band segment. It was noted that the FCC restricts the 29.10 – 29.25 GHz segment for hub-to-subscriber downstream transmissions, with respect to point-to-multipoint systems.

There was solid consensus among the equipment vendors that the A-Block 850 MHz band segment is a definite starter for both PMP and PP equipment, including symmetric and asymmetric frequency-division duplex systems that will likely reserve 100 – 150 MHz as a center guard band.

The group noted that B-Block spectrum, with its pair of 75 MHz segments, is well-suited to narrow-channel equipment, especially TDD equipment (PP or PMP), and that Frequency Division Duplex systems may be quite expensive for the B-Block because the two segments are only 150 MHz apart.

2 Channelization Considerations

Generally all members of the group advocated flexibility in channel width specification. Attendees recommended the following overall objectives and channelization schemes:

2.1 Channel Plan Allowing Co-Existence of Diverse Systems

2.1.1 Consistent Channel Plan(s) for All Band Segments

General consensus was that point-to-point (PP) and point-to-multipoint (PMP) systems, independent of their specific air interface protocol (TDM, TDMA, FDMA, and TDD), should be able to be used in the same band segments. Attendees felt that all band segments in the A-Block and B-Block should be uniformly channelized. Channel widths are left unspecified in the current FCC regulations (47 CFR 101.109) for the A-Block and B-Block spectrum.

2.1.2 Channel Use Coordination

Attendees felt that license holders should take responsibility for their own frequency coordination and the coexistence of different systems that occupy differing channel widths.

2.1.3 QPSK through 64-QAM systems should reasonably co-exist.

Both narrow and wide channel systems should be able to share the same band segments.

2.2 ETSI Channel Plan

2.2.1 Channel Widths

Several attendees recommended adoption of the ETSI channel plan, with channel widths that are integer multiples of 3.5 MHz, such as 3.5, 7, 14, 28, 56, and up to 112 MHz. Supporting these European channel widths would have the benefit of utilizing existing equipment. It was noted that the ETSI channel plan necessitates guard channels at the edges of band segments. Refer to ETS 300-431, 4.1.2, Channel Plan for 24.25 – 29.50 GHz.

2.2.2 Emission Mask

If ETSI channel widths are used, attendees felt that the ETSI emission mask was appropriate, and that it is well defined..Refer to ETS 300-341, 5.3.2 RF Spectrum Mask, Figures 4 and 5.

2.3 U.S. Channel Plan

2.3.1 Channel Widths

Several attendees recommended that a variant of the U.S. channel plan also be supported, as an alternative to the ETSI channel plan. The recommended channel widths are integer multiples of 5 MHz, without an explicit upper bound. This channel plan accommodates existing equipment, and combinations of payload and modulation levels that may not be as well matched to the ETSI channel plan alone. This channel width scheme also utilizes all of the band segments, to their edges without guard regions, especially the B-Block band segments.

2.3.2 Emission Mask

It was agreed that equipment occupying the “U.S.” channel widths (n x 5 MHz) should comply with an emmissions mask that is equivalent to the existing U.S. emissions mask algorithm. Refer to 47 CFR Part 101.111, (a), (2), Page 761.

3 Automatic Transmit Power Control

3.1 Power Control Defined

Attendees agreed that power control is an important spectrum etiquette issue, and that its primary benefits are the minimization of unecessary interference and maximization of frequency re-use.

Power-controlled transmitters would operate with a transmit power level (nominal output) that allows the required bit error rate (BER) performance (different for various systems and service types) in an unfaded condition (the absence of rain or other atmospheric attenuation). The transmitters in power-controlled systems would automatically increase their output power, up to their maximum capability, during and in accordance with the severity of a fading condition. As a fade subsides, a power-controlled transmitter would decrease its transmit power to the nominal output level.

At all times a power-controlled transmitter must meet its emissions mask, as a matter of spectrum etiquette.

3.2 Point-To-Multipoint Systems

The group agreed that the CPE (Customer Premises Equipment) used with PMP systems would be expected to be power controlled. As each CPE unit encountered rain fading between it and the hub its transmit power would be increased. The hub transmitter(s) would be expected to operate at a consistent power level adequate for the most distant CPE during fade conditions.

3.3 Point-To-Point Systems

It was agreed that both ends of PP systems would be power-controlled together.

4 Antenna Patterns

4.1 Polarization

The FCC has specified linear horizontal and vertical polarization for the U.S. spectrum (47 CFR Part 101.117). MPT and other European specs already use linear horizontal and vertical polarization as their defaults also.

4.2 Patterns

It was recommended that antenna radiation characteristics, such as side, back lobes, and cross-polarity isolation, not be specified. Current FCC regulations are silent on antenna patterns.

5 IDU-To-ODU Interface Specifications

The majority consensus was that a standard for Indoor Unit (IDU) to Outdoor Unit (ODU) interface **should not be specified in the early phase standards**. Several of the proponents of an IF interface standard agreed they would separately discuss and review different approaches for future group discussions.

5.1 The Pro/Con Arguments:

- PRO: A standard COAX/IF interface could provide volume leverage for companies who were either modem or millimeter wave RF ODU vendors, leading to lower cost equipment overall.
- PRO: A standard that coincides with existing volume-manufactured technology, such as DVB demodulators, could provide cost leverage.
- PRO: Standards like DAVIC provide a means for various forms of access media – not only wireless – for delivery of services, sharing a common modem. It was generally agreed that if a standard were appropriate, the thoroughness of DAVIC is a good model.
- CON: The stage of equipment design and system architecture for this industry is very early, considerable innovation and change are likely and necessary. A standard interface would be limiting and could potentially inhibit innovation that leads to important cost reductions.
- CON: The DAVIC standard does not take into account the distances between IDU and ODU that are likely in commercial service delivery applications (it was pointed out by many that 2.15 GHz -top end of DAVIC receive IF- over coax has serious distance and signal quality limitations).
- CON: A standard IDU-ODU interface drives an architectural partition that may not lead to the lowest possible CPE costs for PMP terminals.
- CON: Until common air interface standards and CPE payload interface standards (the extremities of a system) are defined, it doesn't make sense to define the 'middle' (IDU-ODU).

6 Spectrum Use Coordination

The group discussed the issue of coordination between adjacent A-Block license holders at the boundaries between their licensed regions, and coordination between A and B-Block licensees in the same BTA. The following coordination issues were raised:

- Minimizing receiver front-end overload.
- Balancing antenna polarities.
- Minimizing transmit power levels.
- Sharing common hub sites (same tower or rooftop).
- Process for arbitration of disputes.

Generally it was agreed that this topic deserves discussion in future meetings.

7 Miscellaneous

One or two attendees stated their desire that, if possible, the channel plan have applicability to MMDS spectrum. It was noted that MMDS channels are 6 MHz wide, and not consistent the consensus to use multiples of either 3.5 or 5 MHz as channel widths.

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